USER GUIDE

TO

1:250,000 SCALE LUNAR MAPS

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GENERAL

In 1972 the NASA Lunar Programs Office initiated the Apollo Photographic Data Analysis Program. The principal point of this program was a detailed scientific analysis of the orbital and surface experiments data derived from Apollo missions 15, 16, and 17. One of the requirements of this program was the production of detailed photo base maps at a useable scale.

NASA in conjunction with the Defense Mapping Agency (DMA) commenced a mapping program in early 1973 that would lead to the production of the necessary maps based on the need for certain areas.

This paper is designed to present in outline form the necessary background information for users to become familiar with the program.

MAP FORMAT

The scale chosen for the project was 1:250,000*. The research being done required a scale that Principal Investigators (PI's) using orbital photography could use, but would also serve PI's doing surface photographic investigations.

Each map sheet covers an area four degrees north/south by five degrees east/west. The base is compiled from vertical Metric photography from Apollo missions 15, 16, and 17. In isolated instances the Apollo oblique metric, Apollo panoramic, and Lunar Orbiter photography were used to fill small gaps or to extend imagery to include features that were the basis for sheet names. Figures 1 and 2 illustrate the area covered by the vertical metric photography.

The numbering system for the series is based on the existing 1:1,000,000 Lunar Astronautical Charts (LAC). Each LAC Region is divided into four provinces lettered A, B, C, or D. Each province is then divided into quarters numbered 1, 2, 3, or 4. The sheet number for each 1:250,000 scale map consists of the LAC number, a province letter, and the number of the quarter. The following "Sheet Numbering Guide" illustrates LAC 58 subdivided into its corresponding 1:250,000 scale map sheets.

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*A scale statement like this simply means 1 unit of measure on the map equals 250,000 of the same units on the moon. (1" on the map equals 250,000" on the moon).

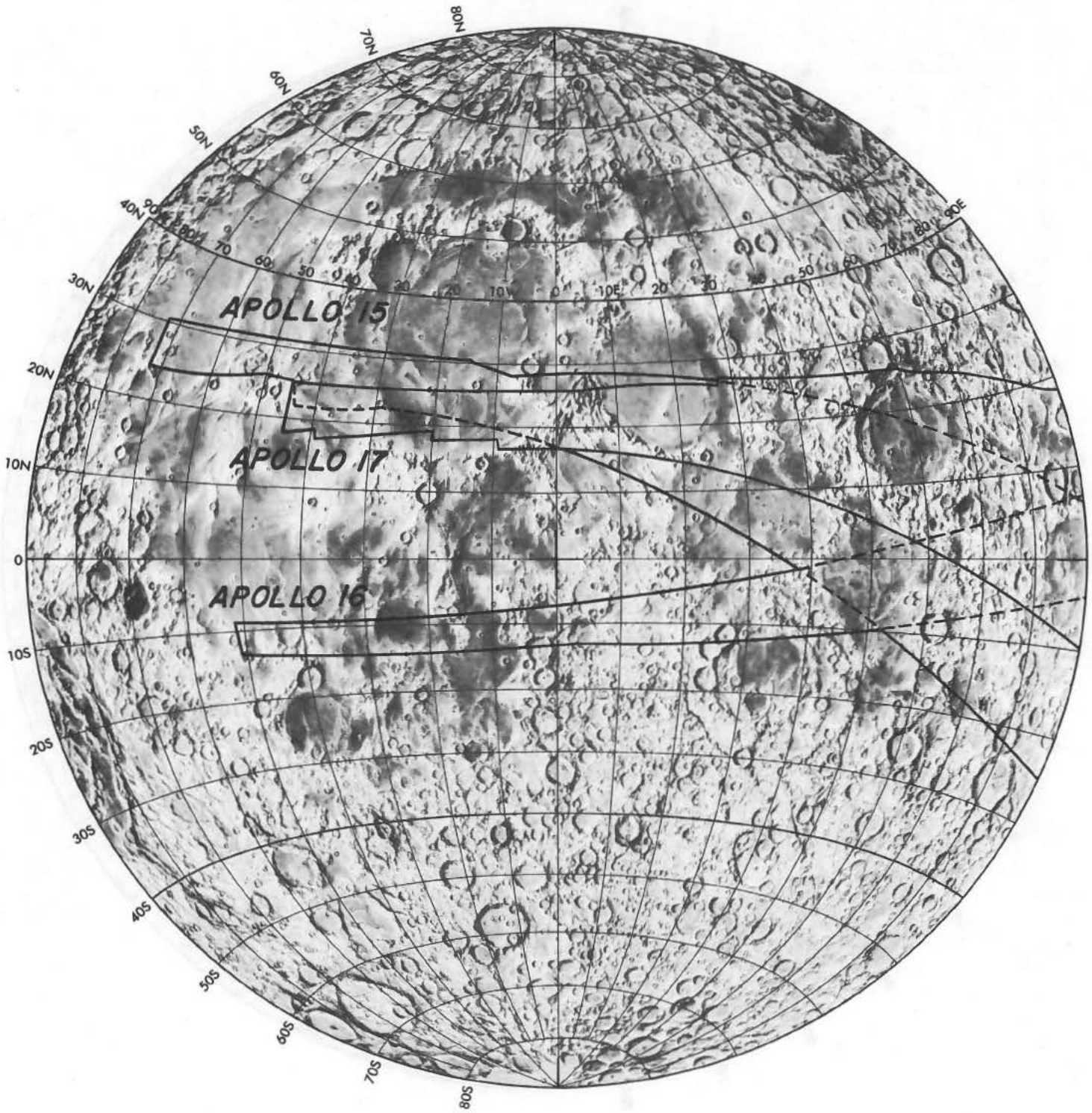

NEAR SIDE
80N
70N
60N
50N
40N
30N
20N
10N
0
10S
20S
30S
40S
50S
60S
70S
80S
90W
80
70
60
50
40
30
20
10W
0
10E
20
30
40
50
60
70
80
90E
APOLLO 15
APOLLO 17
APOLLO 16

FIGURE 1

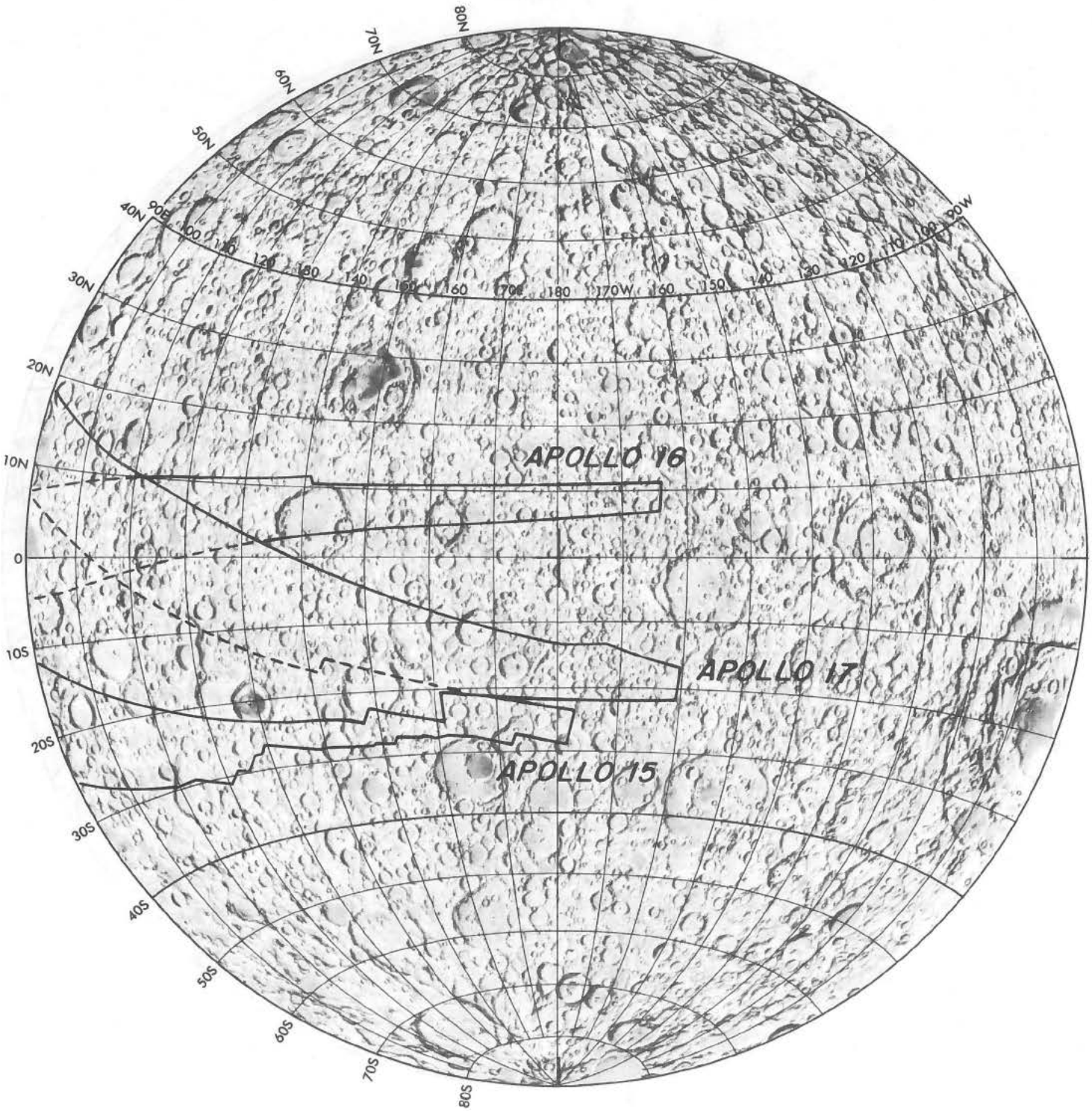
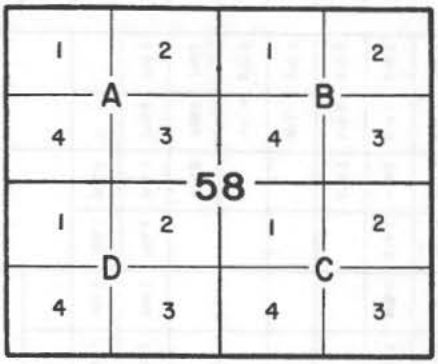

FAR SIDE
80N
70N
60N
50N
40N
30N
20N
10N
0
10S
20S
30S
40S
50S
60S
70S
80S
90E
100
110
120
130
140
150
160
170E
180
170W
160
150
140
130
120
110
100
90W
APOLLO 16
APOLLO 17
APOLLO 15

FIGURE 2

SHEET NUMBERING GUIDE



Figures 3 and 4 locate the 1:250,000 scale maps published through January 1975. Table 1 gives map name in numerical order, and Table 2 gives map name in alphabetical order.

Each 1:250,000 scale map sheet is available in two forms:

1. Lunar Topographic Orthophotomap (LTO)
2. Lunar Orthophotomap (LO)

The basic photographic coverage for the LTO and LO maps is the orthophotomosaic. The LTO contains the grid, names data, and relief represented by contours, elevations, and other relief symbolization as required. The LO contains only the orthophotomosaic base with exterior grid ticks and values.

Map sheets published after 1 May 1974 have lines of longitude numbered 0° to 360° east. Latitude will still be measured in degrees North or South of the equator. A "conversion table" (Table 3) is included to illustrate the new procedure.

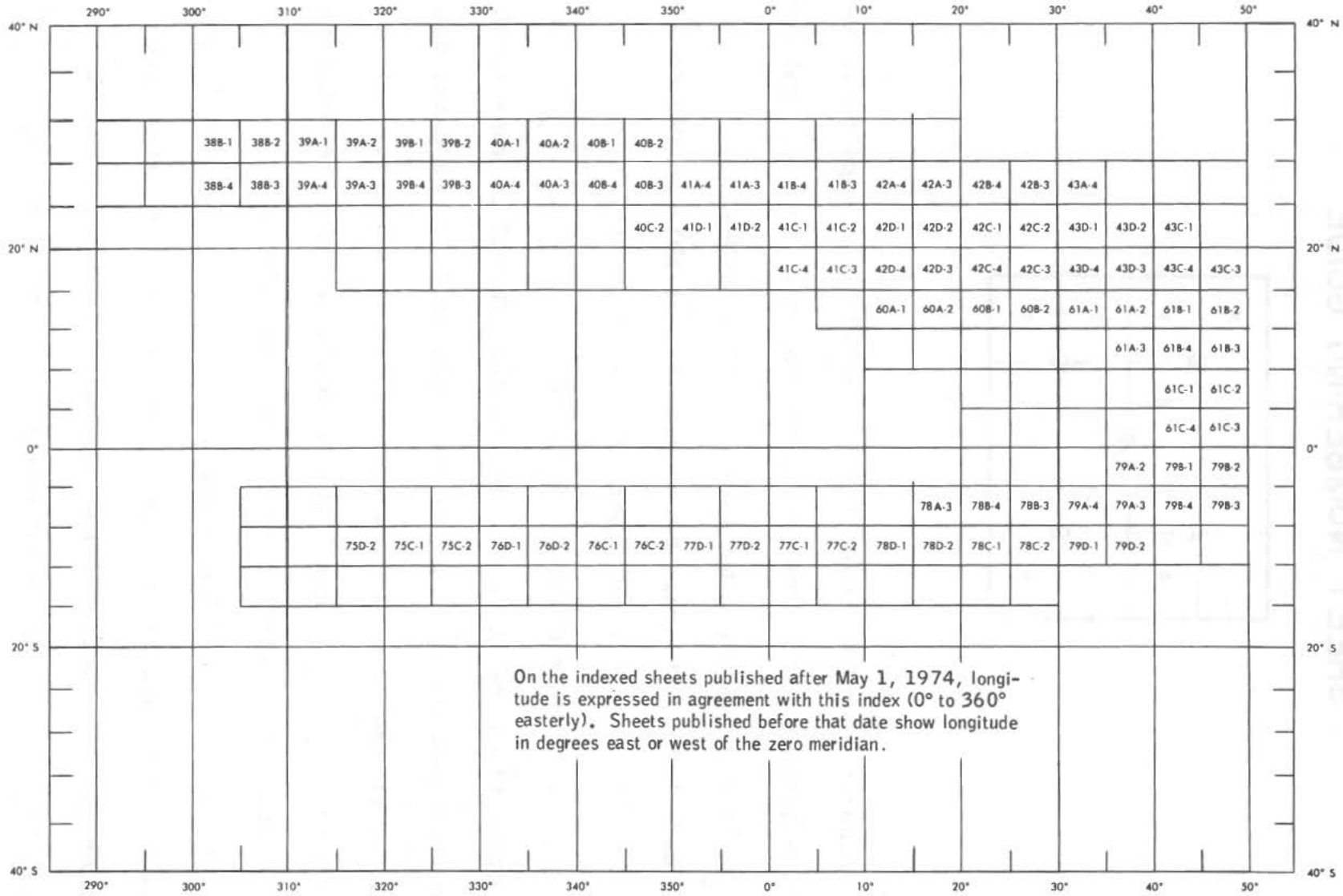

290°
300°
310°
320°
330°
340°
350°
0°
10°
20°
30°
40°
50°
40° N
20° N
0°
20° S
40° S
388-1
388-2
39A-1
39A-2
39B-1
39B-2
40A-1
40A-2
40B-1
40B-2
388-4
388-3
39A-4
39A-3
39B-4
39B-3
40A-4
40A-3
40B-4
40B-3
41A-4
41A-3
41B-4
41B-3
42A-4
42A-3
42B-4
42B-3
43A-4
40C-2
41D-1
41D-2
41C-1
41C-2
42D-1
42D-2
42C-1
42C-2
43D-1
43D-2
43C-1
41C-4
41C-3
42D-4
42D-3
42C-4
42C-3
43D-4
43D-3
43C-4
43C-3
60A-1
60A-2
60B-1
60B-2
61A-1
61A-2
61B-1
61B-2
61A-3
61B-4
61B-3
61C-1
61C-2
61C-4
61C-3
79A-2
79B-1
79B-2
78A-3
78B-4
78B-3
79A-4
79A-3
79B-4
79B-3
75D-2
75C-1
75C-2
76D-1
76D-2
76C-1
76C-2
77D-1
77D-2
77C-1
77C-2
78D-1
78D-2
78C-1
78C-2
79D-1
79D-2
On the indexed sheets published after May 1, 1974, longitude is expressed in agreement with this index (0° to 360° easterly). Sheets published before that date show longitude in degrees east or west of the zero meridian.

FIGURE 3

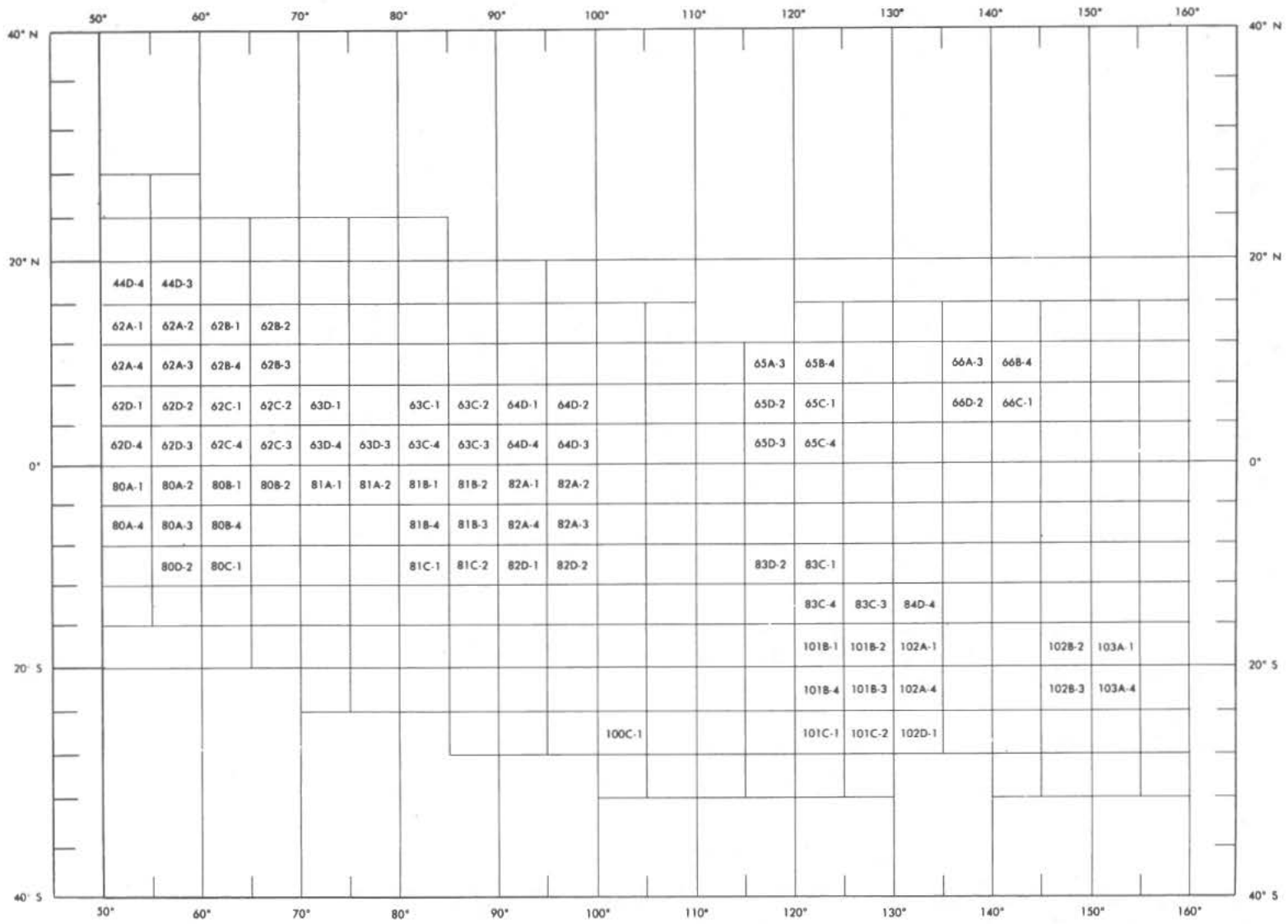

50° 60° 70° 80° 90° 100° 110° 120° 130° 140° 150° 160°
40° N
20° N
0°
20° S
40° S
44D-4 44D-3
62A-1 62A-2 62B-1 62B-2
62A-4 62A-3 62B-4 62B-3 65A-3 65B-4 66A-3 66B-4
62D-1 62D-2 62C-1 62C-2 63D-1 63C-1 63C-2 64D-1 64D-2 65D-2 65C-1 66D-2 66C-1
62D-4 62D-3 62C-4 62C-3 63D-4 63D-3 63C-4 63C-3 64D-4 64D-3 65D-3 65C-4
80A-1 80A-2 80B-1 80B-2 81A-1 81A-2 81B-1 81B-2 82A-1 82A-2
80A-4 80A-3 80B-4 81B-4 81B-3 82A-4 82A-3
80D-2 80C-1 81C-1 81C-2 82D-1 82D-2 83D-2 83C-1
83C-4 83C-3 84D-4
101B-1 101B-2 102A-1 102B-2 103A-1
101B-4 101B-3 102A-4 102B-3 103A-4
100C-1 101C-1 101C-2 102D-1

FIGURE 4

LUNAR TOPO-ORTHOPHOTOMAPS - 1:250,000 SCALE

38B-1	Humason
38B-2	Nielsen
38B-3	Freud
38B-4	Zinner
39A-1	Krieger
39A-2	Angström
39A-3	Prinz
39A-4	Väisälä
39B-1	Fedorov
39B-2	Delisle
39B-3	Diophantus
39B-4	Artsimovich
40A-1	Caventou
40A-2	McDonald
40A-3	Lambert
40A-4	LaHire
40B-1	Sampson
40B-2	Landsteiner
40B-3	Kovalevskij
40B-4	Heinrich
40C-2	Pupin
41A-3	Spurr
41A-4	Beer
41B-3	Joy
41B-4	Hadley
41C-1	Conon
41C-2	Galen
41C-3	Bowen
41C-4	Yangel'
41D-1	Wallace
41D-2	Huxley
42A-3	Banting
42A-4	Linné
42B-3	Very
42B-4	Sarabhai

42C-1	Deseilligny
42C-2	Clerke
42C-3	Dawes
42C-4	Brackett
42D-1	Hornsby
42D-2	Bessel
42D-3	Menelaus
42D-4	Sulpicius Gallus
43A-4	leMonnier
43C-1	Hill
43C-3	Proclus
43C-4	Carmichael
43D-1	Littrow
43D-2	Franck
43D-3	Theophrastus
43D-4	Vitruvius
44D-3	Eckert
44D-4	Peirce
60A-1	Daubree
60A-2	Auwers
60B-1	Plinius
60B-2	Jansen
61A-1	Cajal
61A-2	Lucian
61A-3	Cauchy
61B-1	Lyell
61B-2	Glaisher
61B-3	Watts
61B-4	DaVinci
61C-1	Lawrence
61C-2	Cameron
61C-3	Anville
61C-4	Secchi
62A-1	Yerkes

62A-2	Curtis
62A-3	Shapley
62A-4	Tebbutt
62B-1	Fahrenheit
62B-2	Condorcet
62B-3	Krogh
62B-4	Auzout
62C-1	Firmicus
62C-2	Dubyago
62C-3	Pomortsev
62C-4	Condon
62D-1	Abbot
62D-2	Daly
62D-3	Ameghino
62D-4	Smithson
63C-1	Knox-Shaw
63C-2	Tachinni
63C-3	Peek
63C-4	Schubert
63D-1	Boethius
63D-3	Nobili
63D-4	Respighi
64D-1	Nunn
64D-2	Erro
64D-3	Fox
64D-4	McAdie
65A-3	Guyot
65B-4	Recht
65C-1	King
65C-4	Zanstra
65D-2	Katchalsky
65D-3	Abul Wafa
66A-3	Rutherford
66B-4	Glauber

TABLE 1

66C-1 Fischer

66D-2 Bergman

75C-1 Scheele
75C-2 Norman

75D-2 Winthrop

76C-1 Bonpland
76C-2 Guericke

76D-1 Eppinger
76D-2 Kuiper

77C-1 Albatengnius
77C-2 Halley

77D-1 Davy
77D-2 Ammonius

78A-3 Alfraganus

78B-3 Torricelli
78B-4 Hypatia

78C-1 Kant
78C-2 Mädler

78D-1 Anděl
78D-2 Descartes

79A-2 Leakey
79A-3 Capella
79A-4 Isidorus

79B-1 Lubbock
79B-2 Messier
79B-3 Amontons
79B-4 Gutenberg

79D-1 Daguerre
79D-2 Gaudibert

80A-1 Geikie
80A-2 Webb
80A-3 Bilharz
80A-4 Lindbergh

80B-1 Morley
80B-2 Maclaurin
80B-4 Acosta

80C-1 Somerville

80D-2 Al-Marrakushi

81A-1 Rankine
81A-2 Gilbert

81B-1 Haldane
81B-2 Runge
81B-3 Widmännstatten
81B-4 Kiess

81C-1 Kreiken
81C-2 Houtermans

82A-1 Purkyně
82A-2 Wyld
82A-3 Ludwig
82A-4 Hirayama

82D-1 Brunner
82D-2 Ganskij

83C-1 Danjon
83C-3 Dobrovolskij
83C-4 Delporte

83D-2 Sherrington
84D-4 Volkov

100C-1 Titius

101B-1 Litke
101B-2 Tsiolkovskij Borealis
101B-3 Tsiolkovskij Australis
101B-4 Babakin

101C-1 Neujmin
101C-2 Waterman

102A-1 Patsaev
102A-4 Fesenkov

102B-2 Isaev
102B-3 Andronov

102D-1 Stark

103A-1 Grave
103A-4 Raspletin

LUNAR TOPO-ORTHOPHOTOMAPS - 1:250,000

Abbot	62D-1
Abul Wafa	65D-3
Acosta	80B-4
Albategnius	77C-1
Alfranganus	78A-3
Al-Marrakushi	80D-2
Ameghino	62D-3
Ammonius	77D-2
Amontons	79B-3
Anděl	78D-1
Andronov	102B-3
Angström	39A-2
Anville	61C-3
Artsimovich	39B-4
Auwers	60A-2
Auzout	62B-4
Babakin	101B-4
Banting	42A-3
Beer	41A-4
Bessel	42D-2
Bergman	66D-2
Bilharz	80A-3
Boethius	63D-1
Bonpland	76C-1
Bowen	41C-3
Brackett	42C-4
Brunner	82D-1
Cajal	61A-1
Cameron	61C-2
Capella	79A-3
Carmichael	43C-4
Cauchy	61A-3
Caventou	40A-1
Clerke	42C-2
Condon	62C-4
Condorcet	62B-2
Conon	41C-1
Curtis	62A-2
Daguerre	79D-1
Daly	62D-2
Danjon	83C-1
Daubree	60A-1
DaVinci	61B-4
Davy	77D-1
Dawes	42C-3
Delisle	39B-2
Delporte	83C-4
Descartes	78D-2
Deseilligny	42C-1
Diophantus	39B-3
Dobrovolskij	83C-3
Dubyago	62C-2
Eckert	44D-3
Erro	64D-2
Eppinger	76D-1
Fahrenheit	62B-1
Fedorov	39B-1
Fesenkov	102A-4
Firmicus	62C-1
Fischer	66C-1
Fox	64D-3
Franck	43D-2
Freud	38B-3
Galen	41C-2
Ganskij	82D-2
Gaudibert	79D-2
Geikie	80A-1
Gilbert	81A-2
Glaisher	61B-2
Glauber	66B-4
Grave	103A-1
Guericke	76C-2
Gutenberg	79B-4
Guyot	65A-3
Hadley	41B-4
Haldane	81B-1
Halley	77C-2
Heinrich	40B-4
Hill	43C-1
Hirayama	82A-4
Hornsby	42D-1
Houtermans	81C-2
Humason	38B-1
Huxley	41D-2
Hypatia	78B-4

TABLE 2

Example:

1°W is now 359°

2°W is now 358°, etc.

The medium scale (1:250,000) Lunar Orthophotomaps (LO) and Lunar Topographic Orthophotomaps (LTO) contain two grids: (1) Geographic Coordinate System and (2) Lunar Transverse Mercator (LTM) Grid System.

1. Geographic Coordinate System

The origin of the system is referenced to the center of crater Mösting A (3°10'47" S latitude, 355°09'50" longitude)[1]. Lines of longitude are numbered 0° to 360° east as referenced to the origin of longitude (NASA adopted this procedure for maps published after 1 May 1974); lines of latitude are numbered 0° to 90° progressively north and south from the lunar equator. On the face of the map each 1° interval is shown as a black line extending across the map, and labeled in the margin with its value. The southwest corner of each sheet is appropriately labeled with cardinal directions.

2. Lunar Transverse Mercator Grid System (LTM)

The LTM system consists of equally spaced parallel lines intersecting at right angles to form 10,000-meter squares. The

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[1] Mösting A is the fundamental crater for selenographic measures. It is a small bright crater located closest to the center of the disk.

CONVERSION TABLE

1-359	37-323	73-287	109-251	145-215
2-358	38-322	74-286	110-250	146-214
3-357	39-321	75-285	111-249	147-213
4-356	40-320	76-284	112-248	148-212
5-355	41-319	77-283	113-247	149-211
6-354	42-318	78-282	114-246	150-210
7-353	43-317	79-281	115-245	151-209
8-352	44-316	80-280	116-244	152-208
9-351	45-315	81-279	117-243	153-207
10-350	46-314	82-278	118-242	154-206
11-349	47-313	83-277	119-241	155-205
12-348	48-312	84-276	120-240	156-204
13-347	49-311	85-275	121-239	157-203
14-346	50-310	86-274	122-238	158-202
15-345	51-309	87-273	123-237	159-201
16-344	52-308	88-272	124-236	160-200
17-343	53-307	89-271	125-235	161-199
18-342	54-306	90-270	126-234	162-198
19-341	55-305	91-269	127-233	163-197
20-340	56-304	92-268	128-232	164-196
21-339	57-303	93-267	129-231	165-195
22-338	58-302	94-266	130-230	166-194
23-337	59-301	95-265	131-229	167-193
24-336	60-300	96-264	132-228	168-192
25-335	61-299	97-263	133-227	169-191
26-334	62-298	98-262	134-226	170-190
27-333	63-297	99-261	135-225	171-189
28-332	64-296	100-260	136-224	172-188
29-331	65-295	101-259	137-223	173-187
30-330	66-294	102-258	138-222	174-186
31-329	67-293	103-257	139-221	175-185
32-328	68-292	104-256	140-220	176-184
33-327	69-291	105-255	141-219	177-183
34-326	70-290	106-254	142-218	178-182
35-325	71-289	107-253	143-217	179-181
36-324	72-288	108-252	144-216	180-180

TABLE 3

north-south grid lines are designated as "Easting" (E) lines and the east-west grid lines as "Northing" (N) lines. The primary value of the LTM system is that it enables a user to reference a discrete point on a map without plotting degrees, minutes, and seconds as with the Geographic Coordinate System.

The LTM grid system was developed by dividing the moon in 5° zones numbered consecutively 1 through 72 starting with Zone 1 at 180°-185°, Zone 2 at 185°-190°, etc. (Figure 5). The central meridian for each zone is assigned the coordinate value of 100,000 meters easting.

Example:

- The central meridian for Zone 1 is located midway between 180° and 185° or 182°30' and has a coordinate value of 100,000 meters easting.
- The central meridian for Zone 2 is located midway between 185° and 190° or 187°30' and has a coordinate value of 100,000 meters easting also.

The equator is assigned the coordinate value of 2,500,000 meters. The Northing lines increase in value going north from the equator and decrease in value going south from the equator.

The LTM grid is shown at 10,000-meter intervals by red tick lines emanating from the edge of the map (neatline). Each 10,000-meter tick is labeled with the full 10-kilometer value only (i.e., the central meridian for each zone is labeled 100, rather than

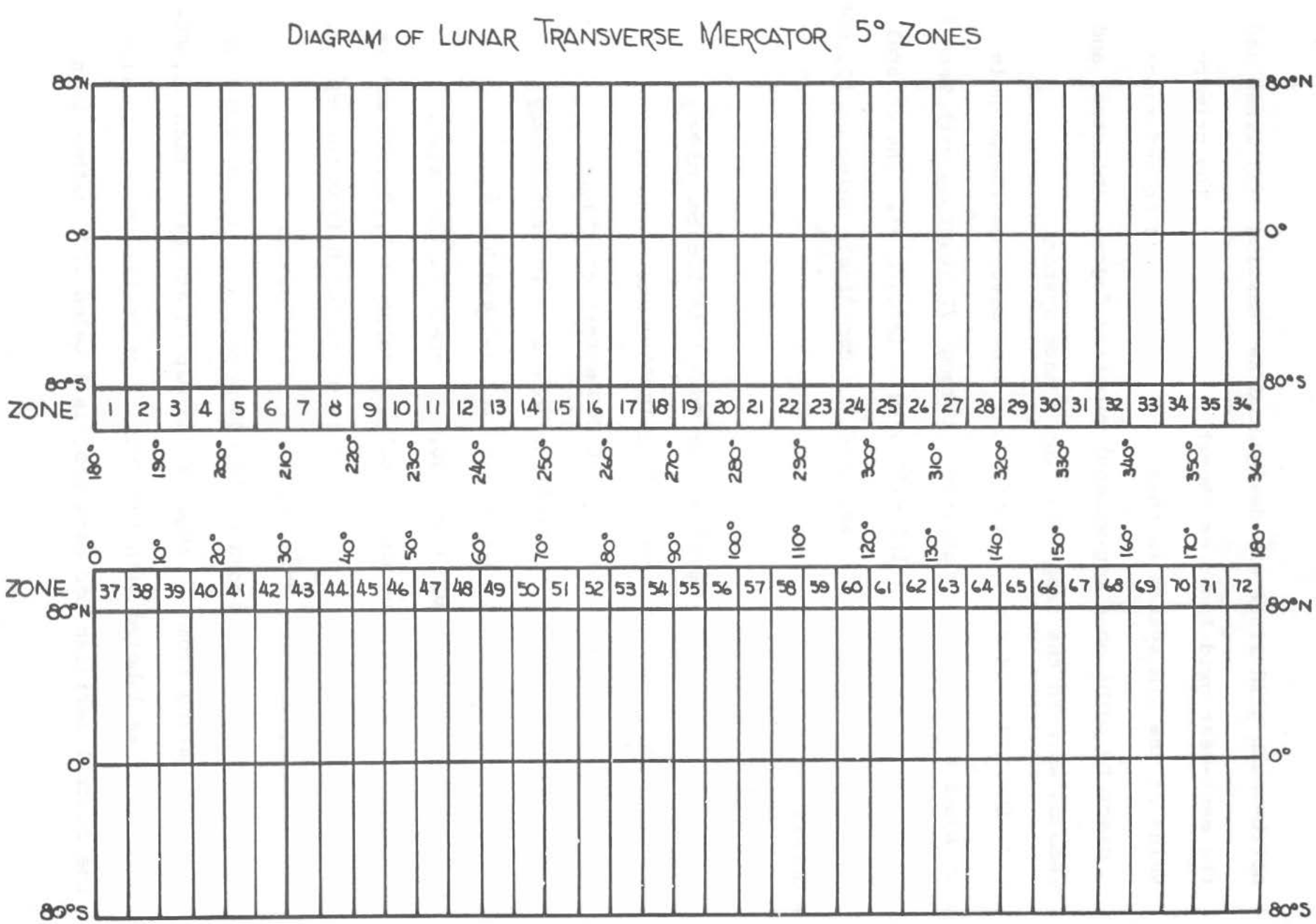
DIAGRAM OF LUNAR TRANSVERSE MERCATOR 5° ZONES
80°N
0°
80°S
ZONE 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36
180° 190° 200° 210° 220° 230° 240° 250° 260° 270° 280° 290° 300° 310° 320° 330° 340° 350° 360°
0° 10° 20° 30° 40° 50° 60° 70° 80° 90° 100° 110° 120° 130° 140° 150° 160° 170° 180°
ZONE 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72

FIGURE 5

100,000). The first LTM grid tick in the southwest corner of each map sheet is shown with full meter values.

Instructions for computing LTM grid coordinates are printed in red on each LO and LTO published.

LUNAR NOMENCLATURE

Maps are one of the basic tools man uses to pass on information. In the case of earth maps we have navigation aids like roads, railroads, rivers, towns, etc. - on the moon we have holes, hills, cracks, rocks, etc.

It would be very difficult for me to write about "the 102.5 mile wide, black-floored crater, with the W-shaped central peak on the backside of the Moon" and have everyone understand which crater I was talking about.

Langrenus is credited as the first to assign names to lunar features (1645). By the year 1900, lunar nomenclature differed so greatly that no one understood it. In 1921, the newly formed International Astronomical Union (IAU) appointed a small committee to clarify the existing situation and to standardize the nomenclature.

When NASA started the 1:250,000 scale map program, it was obvious something would have to be done to increase the number of names. There were many instances of new maps falling between named features. In August, 1973, the IAU met in Sydney, Australia. The delegates were shown examples of the new maps and the problem

of additional names was discussed. Several new policies were adopted and are outlined here.

1. If a lunar feature is important enough to talk about, it should have a name.

2. In the past, lunar names were derived from deceased astronomers or scientists in related fields. The newly adopted policy permits the assignment of names of deceased writers, painters, composers, and other contributors to human culture and knowledge. Excluded are political, military, and religious figures, as well as modern philosophers. Table 4 lists the new lunar names approved by the IAU to date.

3. The system of lunar names also includes, to some extent, a means of classifying broad types of features. Anyone using lunar maps or charts is already familiar with terms like:

Mare (sea)

Oceanus (ocean)

Sinus (bay)

Lacus (lake)

Palus (marsh)

Montes (mountains)

Mons (peak)

Promontoria (cape)

Rupes (scarp)

Vallis (valley)

Rima - plural rimae (rilles)

Newly adopted classifications will be:

Fossa (fossae) - Latin for trench or ditch -- will be used for relatively straight graben.

Anguis (angues) - Latin for snake -- will be used for sinuous rilles.

Catena (catenae) - Latin for chain -- will be used for crater chains.

Dorsum (dorsa) - Latin for backbone -- will be used for sinuous ridges.

Ruina (ruinae) - Will be used for lunar landslides.

NEW NAME	OLD NAME	LOCATION	COMMENTS
FRANCK	RÖMER K	35.6°, 22.6°N	
FRANZ	PROCLUS D	41.0°, 17.4°N	Old name; re-located to more definite feature.
FREDHOLM	MACROBIUS D	46.5°, 18.3°N	
FREUD	——	307.6°, 25.8°N	
GALEN	ARATUS A	4.9°, 21.9°N	
GANSKIJ	GANSKY	97.0°, 9.6°S	Corrected spelling.
GARDNER	VITRUVIUS A	33.8°, 17.8°N	
GOLGI	SCHIAPARELLI D	300.1°, 27.7°N	
GREAVES	LICK D	52.8°, 13.2°N	
HADLEY	HADLEY C	2.8°, 25.5°N	
HALDANE	——	84.0°, 1.7°S	
HARGREAVES	MACLAURIN S	64.1°, 2.1°S	
HEINRICH	TIMOCHARIS A	344.6°, 24.8°N	
HILL	MACROBIUS B	40.8°, 20.9°N	
HORNSBY	ARATUS CB	12.5°, 23.8°N	
HOUTERMANS	——	87.4°, 9.4°S	
HUMASON	LICHTENBERG G	303.3°, 30.7°N	
HUXLEY	WALLACE B	355.5°, 20.2°N	
ISAEV	——	147.5°, 17.5°S	
JENKINS	SCHUBERT Z	78.1°, 0.4°N	
JOY	HADLEY A	6.6°, 25.0°N	
KATCHALSKY	——	116.1°, 5.9°N	
KIESS	——	84.1°, 6.3°S	
KNOX-SHAW	——	80.1°, 5.4°N	
KOVALEVSKIJ	TIMOCHARIS B	347.8°, 27.9°N	
KREIKEN	——	84.6°, 9.0°S	
KROGH	AUZOUT B	65.7°, 9.4°N	
LANDSTEINER	TIMOCHARIS F	345.2°, 31.2°N	
LAWRENCE	TARUNTIUS M	43.3°, 7.5°N	

NEW NAME	OLD NAME	LOCATION	COMMENTS
LIOUVILLE	DUBIAGO S	73.6°, 2.7°N	
LITKE	LÜTKE	123.1°, 16.7°S	Corrected spelling.
LUCIAN	MARALDI B	36.8°, 14.3°N	
LYELL	PROCLUS A	42.2°, 13.3°N	Old name; re-located to more definite feature.
MCADIE	——	92.1°, 2.1°	
MCDONALD	CARLINI B	339.1°, 30.4°N	
MORLEY	MACLAURIN R	64.6°, 2.8°S	
NIELSEN	WOLLASTON C	308.2°, 31.6°N	
NOETHER	CAUCHY D	40.3°, 10.0°N	
PEEK	——	86.9°, 2.6°N	
POMORTSEV	DUBIAGO P	66.9°, 0.8°N	
PUPIN	TIMOCHARIS K	349.0°, 23.9°N	
RAMAN	HERODOTUS D	304.8°, 27.0°N	
RECHT	——	124.0°, 9.8°N	
RESPIGHI	DUBIAGO C	71.9°, 2.8°N	
RUNGE	——	86.8°, 2.5°S	
SAMPSON	——	343.5°, 29.6°N	
SANTOS-DUMONT	HADLEY B	4.7°, 27.8°N	
SARABHAI	BESSEL A	21.0°, 24.7°N	
SCHEELE	LETRONNE D	322.1°, 9.4°S	
SHAPLEY	PICARD H	56.8°, 9.4°N	
SHERRINGTON	——	118.1°, 11.1°S	
SPURR	ARCHIMEDES K	358.7°, 27.9°N	
STEWART	DUBIAGO Q	67.0°, 2.2°N	
SWIFT	PEIRCE B	53.4°, 19.3°N	
TACHINNI	NEPER K	85.9°, 5.0°N	
TEBBUTT	PICARD G	53.5°, 9.5°N	
THEOPHRASTUS	MARALDI M	39.1°, 17.5°N	
TOWNLEY	APOLLONIUS G	63.2°, 3.4°N	

NEW NAME	OLD NAME	LOCATION	COMMENTS
TOSCANELLI	ARISTARCHUS C	312.4°, 27.9°N	
TSIOLKOVSKIJ	TSIOLKOVSKY	129.0°, 20.0°S	Corrected spelling.
VÄISÄLÄ	ARISTARCHUS A	312.1°, 25.9°N	
VAN ALBADA	AUZOUT A	64.4°, 9.4°N	
VAN VLECK	GILBERT M	78.2°, 1.8°S	
VERY	LE MONNIER B	25.4°, 25.6°N	
VOLKOV	——	131.7°, 13.6°S	
WATTS	TARUNTIUS D	46.3°, 8.8°N	
WEIERSTRASS	GILBERT N	77.2°, 1.3°S	
WIDMANNSTÄTTEN	——	85.5°, 6.0°S	
YANGEL'	MANILIUS F	4.7°, 17.0°N	
ZANSTRA	——	124.8°, 2.9°N	
ZASYADKO	——	94.2°, 3.9°N	
ZINNER	SCHIAPARELLI B	301.1°, 26.6°N	